(12) UK Patent Application (19) GB (11) 2 321 865 (13) A

(43) Date of A Publication 12.08.1998

(21) Application No 9802098.5

(22) Date of Filing 30.01.1998

(30) Priority Data
(31) 19704110 (32) 04.02.1997 (33) DE

(71) Applicant(s)
Robert Bosch GmbH
(Incorporated in the Federal Republic of Germany)
Wernerstrasse 1, Stuttgart-Feuerbach,
D-70442 Stuttgart 30, Federal Republic of Germany

(72) Inventor(s)
Gerd Berner

(74) Agent and/or Address for Service
A A Thornton & Co
Northumberland House, 303-306 High Holborn,
LONDON, WC1V 7LE, United Kingdom

(51) INT CL^6
B25F 5/00 , B24B 23/06 , F16H 57/02 57/12

(52) UK CL (Edition P)
B3D DUD D100 D201
F2Q Q7A3X

(56) Documents Cited
GB 0249340 A EP 0548717 A1 CH 000653758 A

(58) Field of Search
UK CL (Edition P) B3D DJP DUD , F2Q Q7A3X
INT CL^6 B23Q 5/04 , B24B 23/06 , B25F 5/00
ONLINE: WPI

(54) Abstract Title
Adjustment of the gearing of a hand machine tool

(57) A hand machine tool, such as hand band sander 10, has a housing 112 and 212 containing a ring gear 115 and pinion 215 gearing, the ring gear 115 being non-rotatably attached to an output shaft 91 towards an end thereof supported in a rolling-contact bearing 95. The clearance between the pinion 215 and ring gear 115 being adjusted to accommodate unavoidable manufacturing variations in the tool by axial movement of the output shaft 91 through rotation of an adjusting disc 94 on which the bearing 95 is supported. The adjusting disc 94 and the adjacent wall of the housing 112 preferably have means 96, 196 (and Figs. 3-6, 100 and 1100) to secure the disc 94 in its rotary position. The ring gear 115 is supported in a grease cup 98 that also serves as a spring, pressing the output shaft 91 and the bearing 95 towards the adjusting disc 94.

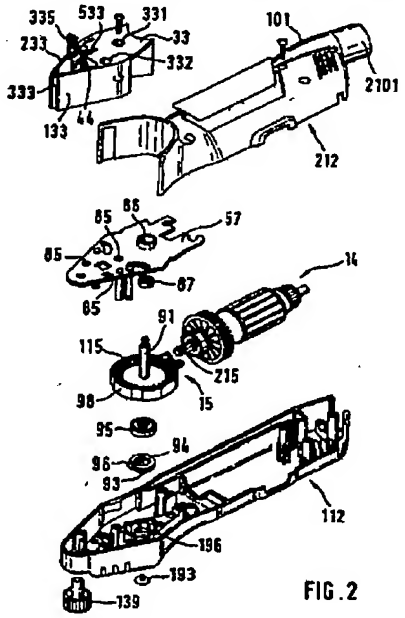


FIG.2

GB 2 321 865 A

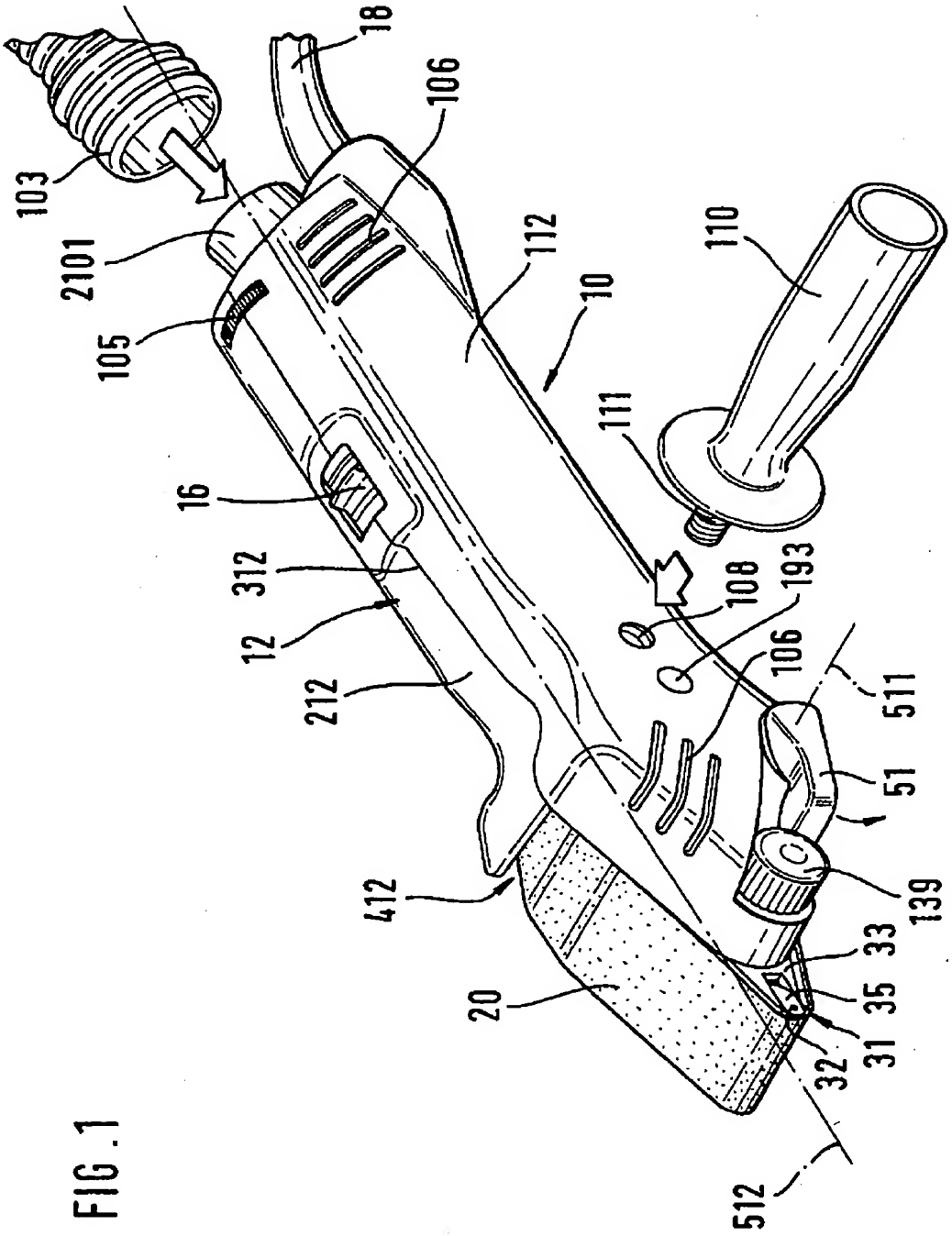

18
106
103
2101
112
110
105
10
111
16
108
193
312
106
12
511
212
51
412
139
33
20
35
31
32
512

FIG. 1

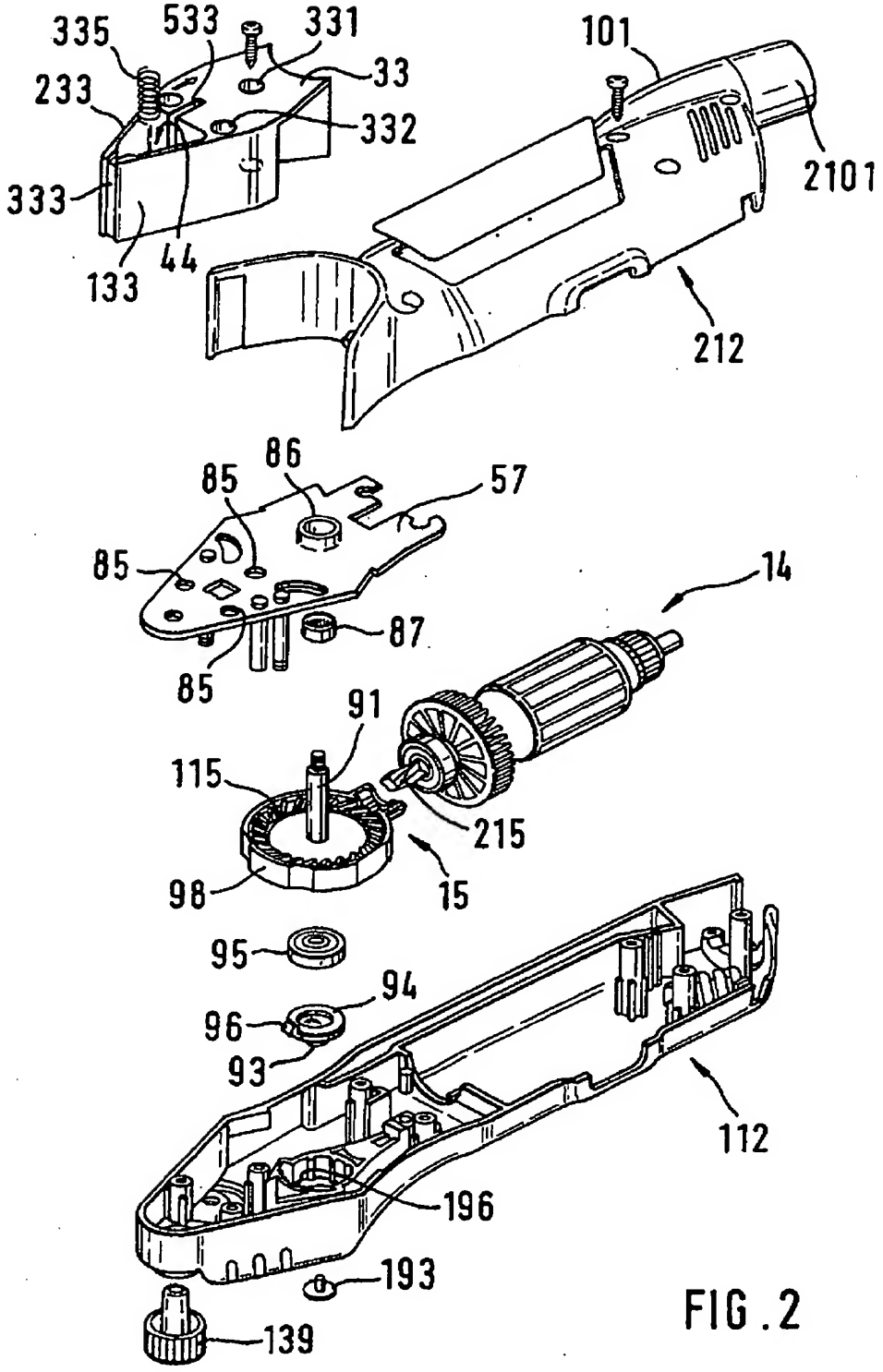

335
533
331
33
233
332
333
133
44
101
2101
212
86
85
57
85
87
85
14
91
115
215
98
15
95
94
96
93
112
196
193
139

FIG. 2

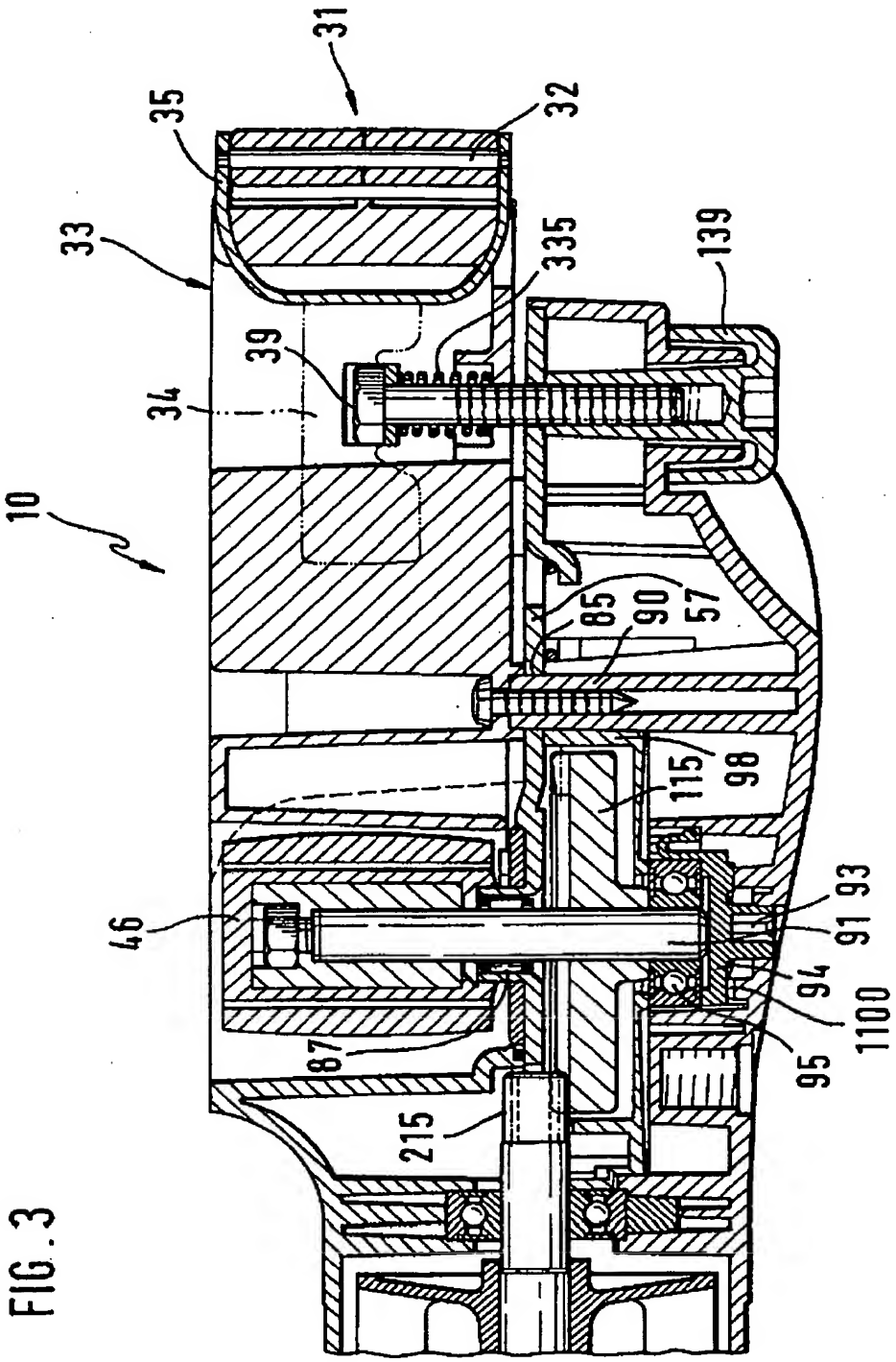

31
35
32
33
335
139
39
34
10
85
90
57
115
98
46
91
93
94
1100
95
87
215

FIG. 3

FIG. 4

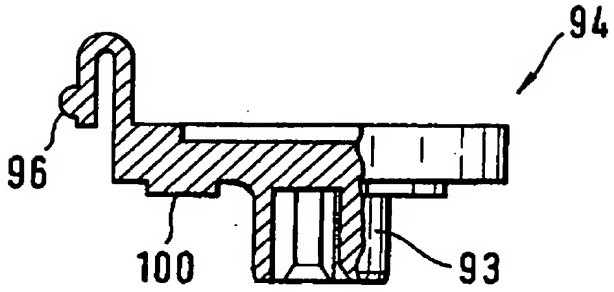


FIG. 5

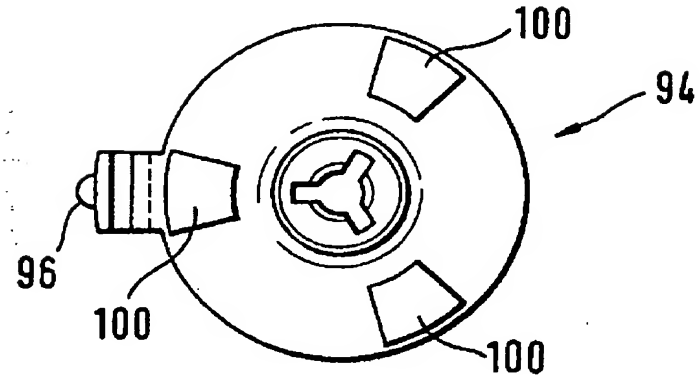
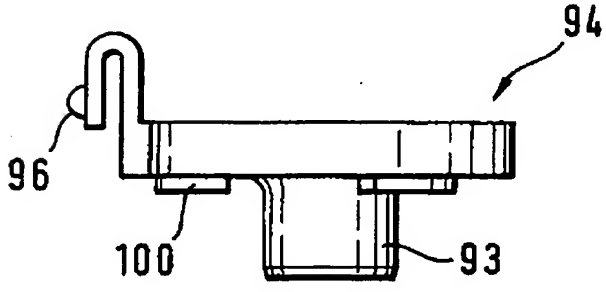


FIG. 6



Hand band sander

Background art

The invention proceeds from a hand band sander according to the preamble of claim 1.

From US 4,694,616 a small hand band sander is known having a driving roller and two guide rollers, which have a substantially identical diameter. The latter guide the abrasive band over an abrasive heel disposed resiliently and exchangeably on the appliance. Said handy appliance lends itself well to machining smaller surfaces of varying profile but, because of the relatively large diameters of the driving and guide rollers of the hand band sander and because of the non-aligned tangential transitions between the rollers and the abrasive heel, it is difficult to access corners and channels for machining.

From DE-OS 42 26 708, moreover, a stationary band sander is known, the abrasive band of which is guided over at least four rollers and which has no abrasive heel. Said band sander is intended for sanding tasks where workpieces are to be machined only directly at the abrasive band surface at the wrap region of the rollers, in particular for producing concave surfaces.

Furthermore, from DE-OS 39 19 651 a hand band sander is known which, besides the conventional guide and driving rollers of substantially equal size, has a small additional guide roller used for guiding the abrasive band in a tangentially aligned manner between the guide roller and the abrasive heel. With said appliance corners and channels are much more accessible than with other hand band sanders. However, since its construction is based on the conventional hand band sander

principle, its band centring and band tensioning devices are of a complex design owing to the additional small guide roller.

With such electric tools having plastic housings, it is impossible to dispense with a more or less individual gear clearance adjustment because of the unavoidable manufacturing tolerances, e.g. as a result of contraction of the housing during cooling.

Hitherto, the gear clearance at the band has been adjusted by placing adjusting washers, which are tuned to a specific batch or number of appliances, on both sides of the locating bearing in the output train. Insertion of the adjusting washers requires a great deal of skill and also entails a risk of, for example, damage to the sealing washers of the bearing or incorrect insertion of the adjusting washers.

Advantages of the invention

In contrast, the hand band sander according to the invention having the characterizing features of claim 1 has the advantage of greatly improved handling, simplification of manual adjustment of the band centring device as well as with regard to the number of individual parts, manufacture and assembly.

A further advantage is provided in that a fixed base plate like a backbone carries the band tensioning mechanism and the abrasive shoe as well as further parts in a preassemblable manner prior to its mounting into the housing. The base plate serving as a bearing cover also performs other tasks such as accommodation of the rolling-contact bearing of the output shaft carrying the driving roller and accommodation and positioning of the thrust ring. The bearing cover, despite performing a variety of functions, is a simple punching. As it is also mounted

without additional parts between guide shoe and housing shells, only very few individual parts are required and assembly is simplified.

A further advantage arises in that adjustment of the gear clearance during manufacture is considerably simplified because it may be effected from the outside of the appliance after the latter has been completely assembled and does not require additional parts, e.g. adjusting washers.

For the purpose of gear clearance adjustment, a profiled mandrel was therefore led out of the housing. By rotating said profiled mandrel using a special spanner or optionally a screwdriver, the gear clearance is adjustable in detent stages. (Adjustment is not to be capable of being effected in a straightforward manner by the user.) For said purpose, the profiled mandrel is part of an adjusting plate which is situated between the locating bearing of the output shaft and the housing outer wall.

The surface of the adjusting plate directed towards the housing wall takes the form of an annular key, which is supported against a surface likewise fashioned as an annular key integrated into the housing wall. Turning of the adjusting plate therefore results in an axial movement of the locating bearing, supported thereon, of the output shaft. For latching into specific rotary positions, the adjusting plate has a radial, resiliently fashioned lug which latches into radial detent grooves in the housing or the longer shell of the housing. To prevent a gear clearance adjustment in the event of high axial forces upon the output shaft, the annular key is designed to be self-locking. The adjusting plate with screw head is radially guided without an additional bearing arrangement directly in the housing. The adjusting plate made of plastic material in turn represents the bearing seat for the locating bearing.

The counterforce, which is necessary for keeping within the gear clearance and which presses the output shaft and hence the locating bearing permanently towards the adjusting plate, is applied by means of an additional grease cup. Besides its actual function, namely delimitation of the grease area around the ring gear, its base is fashioned in such a way that allows it to yield and spring axially in the manner of a cup spring. During installation, said grease cup is preloaded by the gear cover and hence exerts the necessary contact pressure upon the locating bearing.

Adjustment is realized by means of an annular key in conjunction with a grease cup in the form of a cup spring, which simultaneously forms the bearing seat for the locating bearing of the output shaft. By virtue of a resilient detent lug and suitable notches in the housing a scale-like, overlatching adjustment of the gear clearance is possible. The selected setting is automatically maintained on account of the notches and a self-locking design of the annular key. An important advantage of the invention is simple and reliable adjustment of the gear clearance from the outside, the low parts number and dispensing with adjusting washers.

Thus, the abrasive heel, the gear cover, the housing and the band tensioning means comprise inventive features, the abrasive heel and the gear cover being an important structural part or replacement part, on which differently equipped abrasive bands or the like may be disposed.

Drawings

There follows a detailed description of an embodiment of the invention with reference to the accompanying drawings.

The drawings show

Figure 1 a three-dimensional view of an embodiment of the hand band sander according to the invention,

Figure 2 an exploded view of the hand band sander according to the invention limited to the housing and the gearing,

Figure 3 a longitudinal section of the front region of the hand band sander,

Figure 4 a partial section of the adjusting plate and

Figures 5,6 a plan view and a side view of the adjusting plate.

Description of the embodiment

The hand band sander 10 shown in Figure 1 is of a slim, lance-like design having working surfaces of its abrasive band 20 which taper in the shape of a wedge almost to a point in a forward direction, its housing 12 extending straight back in a longitudinal direction, for receiving the gearing 15 and the merely indicated motor 14 (Figure 3). The oblong, rod-shaped housing 12 comprises a longer and a shorter shell 112, 212, which are joined together along a central butt joint 312. In the rear region, the housing 12 carries an on/off switch 16 for operation of the motor for rotating the abrasive band 20. Emanating from the rear end of the housing 12 are an electric cable 18 and, adjacent thereto, an extraction connection piece 2101 of the dust extraction channel 101, Fig. 3, adjacent to the setting wheel 105 of an electronic speed selection device. Lateral venting slots 106 are moreover situated in the rear and front region of the housing 12. In the wedge-shaped, front region of the housing 12 the shorter shell 212 forms, relative to the longer shell 112, a recess 412 in which an abrasive band 20 is guided in such a way that, when viewed laterally, it is substantially aligned with the contour of the longer shell 112.

The abrasive band 20 is carried by a guide shoe 33, Figure 3, formed in the shape of a wedge with its point 333 directed forwards. The guide shoe 33 is provided at its wedge surfaces with two abrasive heels 133, 233 and carries in front of its point 333 on a connecting rod 34 with fork 35 a guide roller pair 31, which is rotatably supported by means of a spindle 32 (Figure 3) in the fork 35. At the opposite side to the guide roller pair 31, the abrasive band 20 is conveyed over a driving roller 46, Figure 3. A housing axis 512 illustrated by a dash-dot line indicates the longitudinal extension of the hand band sander 10.

A rotary button 139 for adjusting the centred position of the abrasive band 20 is disposed in the front region of the longer housing shell 112 so as to project laterally, said rotary button being integrated in a flush manner into the housing contour by virtue of its arrangement in an indentation. When the rotary button 139 is rotated, the connecting rod 34 carrying the fork 35 with the spindle 32 and the guide rollers 31 is swivelled in one or the other direction depending on the direction of rotation.

Closely adjacent to the rotary button 139 the hand band sander 10 carries a likewise laterally projecting clamping and release lever 51, which is integrated in a flush manner into the housing contour by virtue of its arrangement in the indentation and which, when swivelled downwards about its axis 511, releases the abrasive band 20 for exchange purposes.

An extraction hose 103, which is connected to an external dust extractor (not shown) and used to extract the abrasive dust, is connectable to the extraction connection piece 2101.

An additional handle 110 may be screwed by its threaded piece 111 laterally into a threaded bore 108 in the front region of the longer shell 112 of the housing 12. By said means, the hand band sander 10 may be used in a particularly sensitively controllable manner.

Figure 2 shows the hand band sander 10 in an exploded view, which clearly reveals its construction, its individual parts and their function, in particular that the housing 12 comprises a longer and a shorter shell 112, 212 and that the difference in length creates a recess 412 in the front region. Said recess is tightly closed by means of a gear cover 57 in the region of the butt joint. The region between the longer shell 112 and the gear cover forms the gear case, in which is seated the angular gear 15 comprising a ring gear 115 and a small pinion 215. The small pinion 215 carries (not described in detail) a rolling-contact bearing and, axially adjacent thereto, a fan impeller adjoined by a rotor of the motor 14 (partially shown). The small pinion 215 meshes with the ring gear 115 of the gearing 15, which ring gear is embraced by a grease cup 98 containing a small grease deposit (not shown) and is centrally connected non-rotatably to an output shaft 91. The grease cup 98 with a lateral shell-type semi-connection piece also partially encloses the smaller pinion 215 in a lubricating manner.

Above the shorter shell 212 there is the guide shoe 33 with its point 333, the lateral opening 44 verging into a slot 533 and the bores 331, 332 of said guide shoe being clearly visible.

A screw (not shown) is adjustable by means of the setting button 139 and effects a swivelling of the connecting rod 34 together with the guide rollers 31 for centring the band run.

Also shown above the longer shell 112 is the adjusting plate for adjusting the gear clearance between the pinions 115, 215 through axial displacement of the output shaft 91 by means of a profiled mandrel 93 of the adjusting plate 94, which profiled mandrel passes out through the housing 112 for adjustment of the gear clearance by means of a special tool, the internal profile being closable by means of plugs 193. Also visible is the locating bearing 95 which is supported on the adjusting plate 94. The adjusting plate 94 has a detent lug 96, with which it may engage into a detent profile 196 disposed in the shell and hence is lockable in each adjustment position. The adjusting plate 94 moreover has, on its underside, a plurality of axially projecting segments with an annular key profile 100, which is situated on a corresponding counterpart profile of the shell 112 in the support region of the adjusting plate 94.

For fixing the gear cover 57 in the housing 12, said gear cover is provided with bores 85, into which housing mandrels 90 engage during assembly. During assembly, the gear cover 57 is clamped in between the guide shoe 33 and the housing 12 and fixed in connection with said positioning mandrels 90. No further fastening elements are therefore required.

Besides receiving the tensioning mechanism, the gear cover 57 performs additional tasks. A collar 86 produced during the punching process receives the needle bearing 87 for the drive shaft 91. The guide shoe 33 is centred by means of the mandrels 90 in the housing 12 and is supported by means of the gear cover 57 on the housing 12.

Figure 3 shows the front region of the hand band sander 10 in longitudinal section, the arrangement of the gearing 15 comprising the small pinion 215 meshed with the ring gear 115 being clearly visible. Unlike conventional angular gears, the ring

gear 115 is non-rotatably coupled axially to the end and not the middle of the output shaft 91, the teeth being directed towards the output side and meshing there with the small pinion 215. The result is therefore a particularly flat gearing which may easily be embraced by a shell-like grease cup 98, which is supported against the housing side, and hence may be reliably lubricated by a very small grease deposit.

It is also evident that the axial end of the output shaft 91 embraced by the locating bearing 95 is supported against an adjusting plate 94 made of plastic material, which with an axially central mandrel 93 penetrates the wall of the shell 112 of the housing 112 of the housing 12 and is rotatable from the outside using a special tool or alternatively a screwdriver or the like.

The adjusting plate 94 at its side directed towards the housing 12 carries four uniformly distributed, axially projecting annular keys 100, which are supported on counterpart annular keys 1100 carried in a mirror-inverted manner by the housing 12. When the adjusting plate 94 is rotated, e.g. as a result of engagement of a screwdriver into the profile of the mandrel 93, the adjusting plate is displaced - depending on the supporting position of the annular keys 100, 1100 on one another - axially upwards and downwards.

A cup-spring-like, radially projecting detent lug 96 on the outer edge of the disc-shaped adjusting plate 94 engages resiliently into a radial detent profile integrated in the shell 112 at the seat of the adjusting plate 94 and/or of the locating bearing 95 and hence in each setting position is latched over, thereby preventing unintentional rotation. The angles of the annular keys 100, 1100 are selected so as to be self-locking to prevent them from being automatically displaced in the event of high axial pressure.

To prevent the adjusting plate 94 from being adjustable by unauthorized persons or in some other unintentional manner, a plug 193 is insertable axially from the outside into the mandrel 93 in a manner which is difficult to remove. The grease cup 98 serves as a cup spring, which has a tendency to press the output shaft 91 towards the locating bearing 95 and so ensures relatively constant axial forces at the output shaft 91 and hence a long gearing life.

Claims

1. Hand machine tool (10) having a housing (12), disposed in which is a gearing (15), comprising in particular a ring gear (115) and a pinion (215), with an output shaft (91) supported in at least one rolling-contact bearing (95), characterized in that the output shaft (91) is supportable in an axially adjustable manner in the housing (12), the axial position of the output shaft selectably determining the gear clearance.

2. Hand machine tool according to claim 1, characterized in that the hand machine tool is a hand band sander (10), the output shaft (91) of which is seated in a rolling-contact bearing (95) and supported via a flat surface of an adjusting disc (94) against the wall of the housing (12), wherein the adjusting disc (94) at its side directed towards the housing (12) carries at least one annular key (100), which is supported against at least one other, mirror-inverted counterpart annular key (1100) carried by the wall of the housing (12), and carries, preferably centrally, a mandrel (93) which penetrates the wall of the housing (12).

3. Hand machine tool according to claim 2, characterized in that the mandrel (93) has axial engagement surfaces for a tool, e.g. screwdriver, for rotating the adjusting disc (94).

4. Hand machine tool according to claim 2, characterized in that the wall of the housing (12) carries a recess, which embraces the mandrel (93) as a sealing rotary bearing arrangement.

5. Hand machine tool according to claim 2 to 4, characterized in that a plug (193) for closing the engagement surfaces of the mandrel (93) is insertable in a captive manner into said surfaces.

6. Hand machine tool (10) having a housing (12), disposed in which is an angular gearing (15), comprising in particular a ring gear (115) and a pinion (215), with an output shaft (91) supported in at least one rolling-contact bearing (95), characterized in that the ring gear (115) is non-rotatably connected to the output shaft (91) close to the latter's end axially supported in the housing (12) and that the teeth of the ring gear (115) are disposed directed away from the housing (12) and towards the output side, and that the ring gear (115) is supported in that it is embraced by a grease cup (98), which is closed towards the housing side and contains a grease deposit.

7. Hand machine tool according to claim 6, characterized in that the grease cup (98) serves as a cup spring and resiliently preloads the output shaft (91) axially towards the locating bearing (95).

8. Hand machine tool according to one of claims 1 to 7, characterized in that the hand band sander (10) has a lance-like contour in that the parts (31, 33) carrying the abrasive band (20) are disposed in front of a rear region of the oblong housing (12) and guided in such a way that they form in the front region of the housing (12) a centrally forward-pointing, freely projecting wedge point (333).

9. Hand machine tool according to claim 2 to 8, characterized in that the hand band sander (10) has a further abrasive heel (233).

10. Hand machine tool according to claim 9, characterized in that the guide roller (31) has a diameter of 8 mm.

11. Hand machine tool according to claim 2 to 4, characterized in that latch-over means are disposed between the adjusting plate (94) and the shell (112) and secure the rotary position of the adjusting plate (94).

12. A hand machine tool substantially as herein described with reference to the accompanying drawings.